

TES limb retrievals using MIPAS Algorithms

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Aura Science Meeting, Le Hague, The Netherlands

Outline

- ❖ Two FTS sounders: MIPAS and TES (limb).
- ❖ Strategy for comparison: resampling and spectral microwindows
- ❖ Oxford retrieval algorithm: examples of p,T, H₂O, O₃ and HNO₃ retrieved profiles
- ❖ Preliminary results on comparisons for 28Jan05
- ❖ Preliminary conclusion and further work



High Resolution FTS observing atmospheric emissions

TES: Tropospheric Emission Spectrometer (Aura Satellite)

- ❖ infrared nadir and **limb** sounder ($650\text{-}4250\text{cm}^{-1}$),
- ❖ 16 detectors (from the surface to about 33 km),
- ❖ limb spectral resolution: 0.02 cm^{-1}

MIPAS: Michelson Interferometer for Passive Atmospheric Sounding (Envisat Satellite)

- ❖ infrared limb sounder ($685\text{-}2410\text{cm}^{-1}$),
- ❖ scan mirror (from 6 to 70 km),
- ❖ full spectral resolution: 0.025 cm^{-1}
- ❖ in the new resolution mode, following problems with the interferometer slide mechanism, the MIPAS spectral resolution has been reduced by 40%, **0.0625 cm^{-1}**

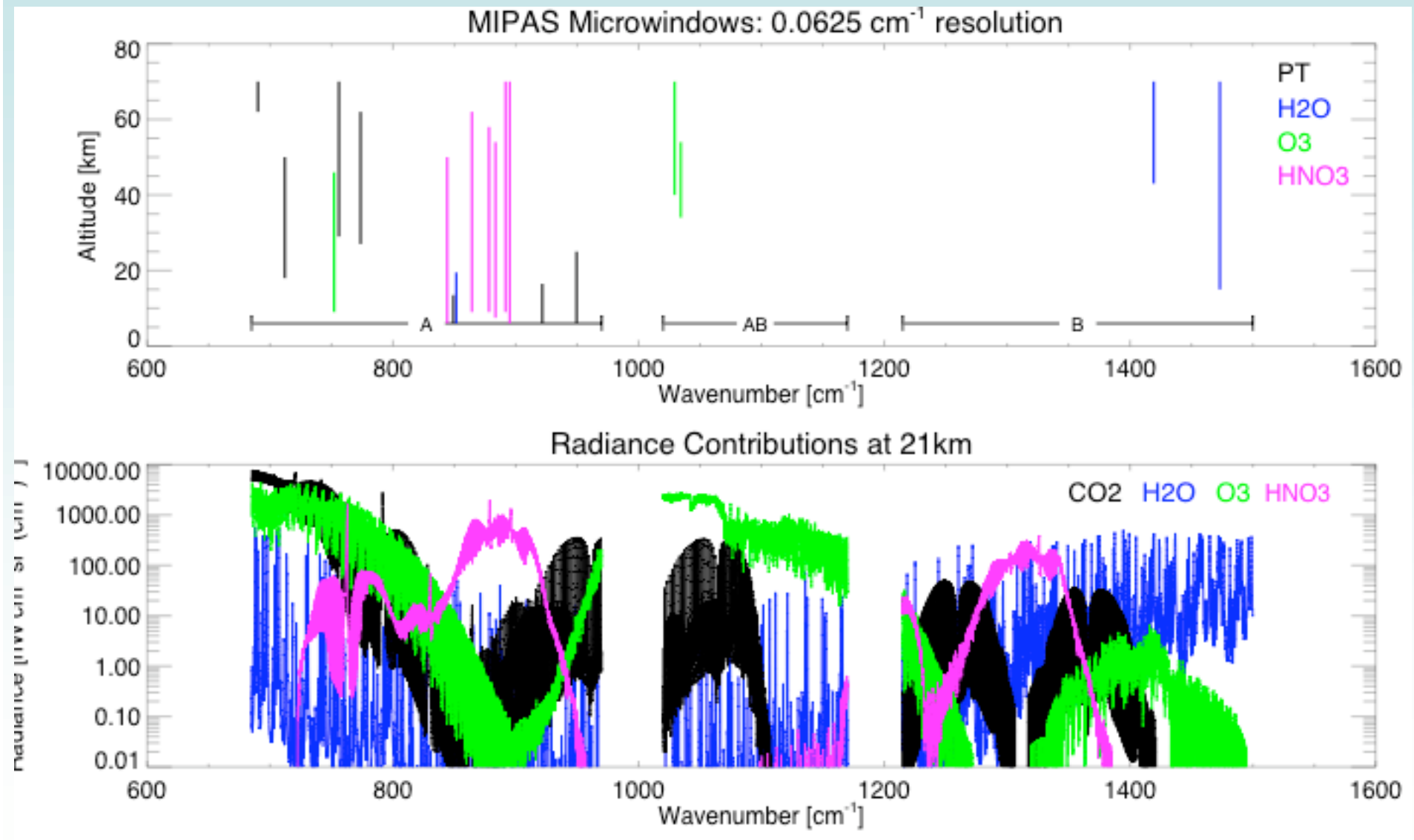


Strategy for Comparison

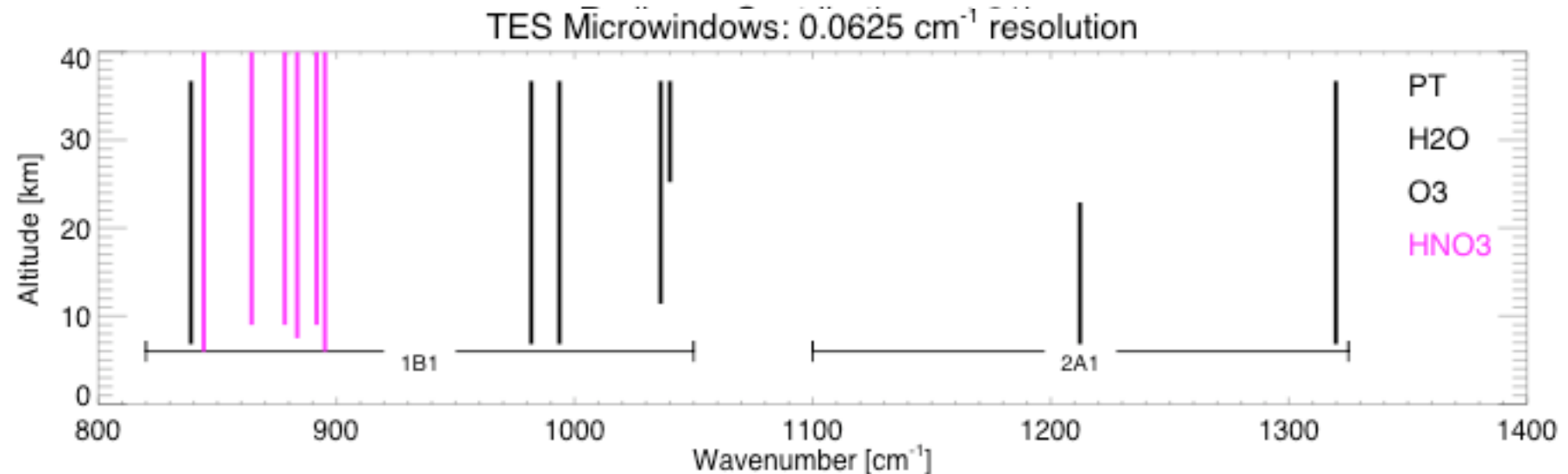
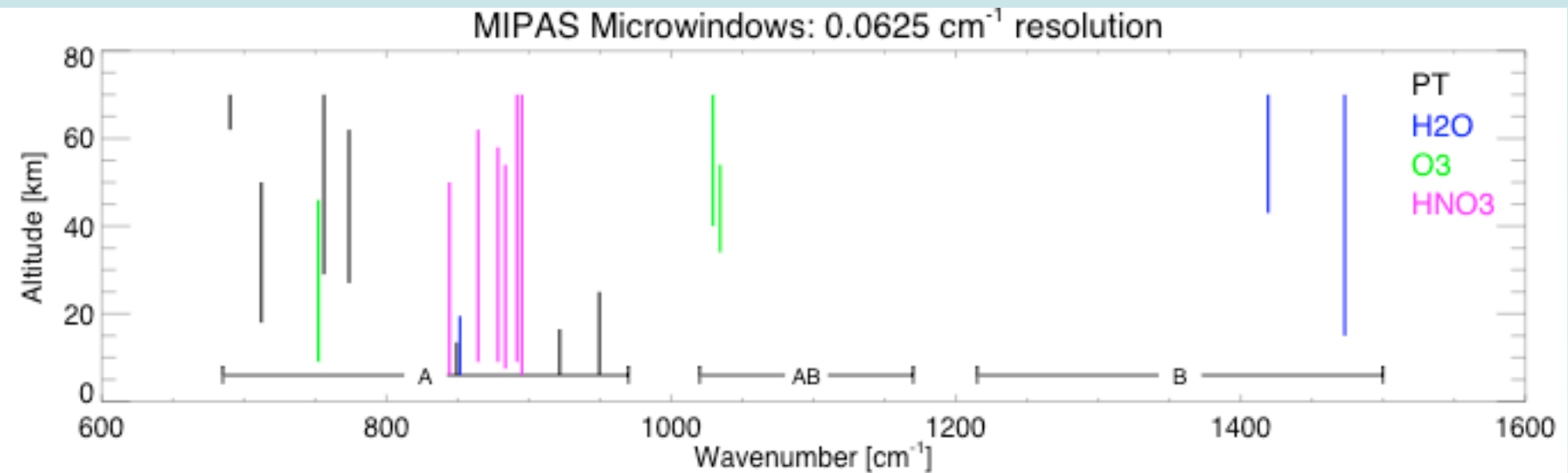
- ❖ New MIPAS Mode Activities
 - ❖ Reduced resolution 0.0625 cm^{-1}
 - ❖ 27 step elevation scan (6,7.5,9,...,70km) and floating lower altitude (3-9 km from pole-equator)
- ❖ For the intercomparison, we decided to resample the TES limb spectra to 0.0625 cm^{-1} in order to use the spectral microwindows selected for MIPAS (accuracy for H₂O is limited by random noise).
- ❖ Selection of spectral microwindows for TES at 0.0625 cm^{-1} : joint retrieval of pressure, temperature, H₂O and O₃ (band 2B1 [650 – 900 cm^{-1}] has been avoided because highly noisy).

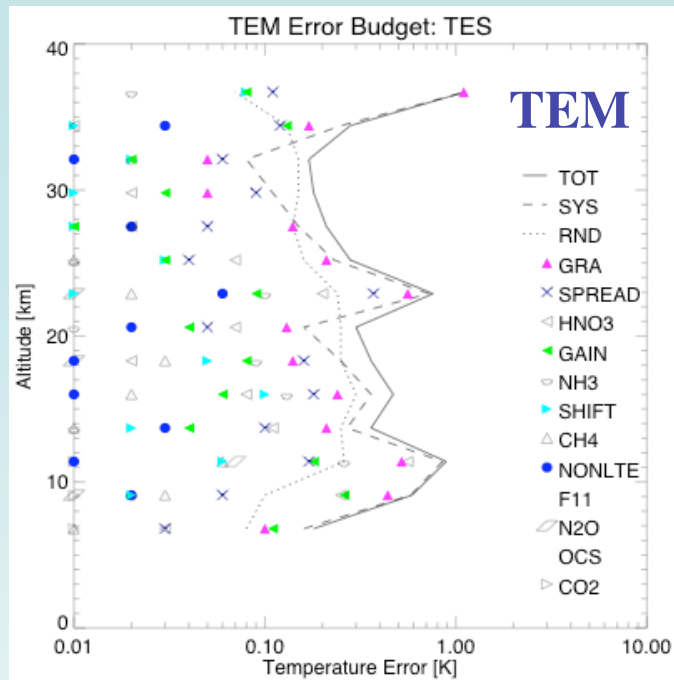


MIPAS microwindows: 0.0625 cm^{-1}



MIPAS and TES microwindows: 0.0625 cm^{-1}





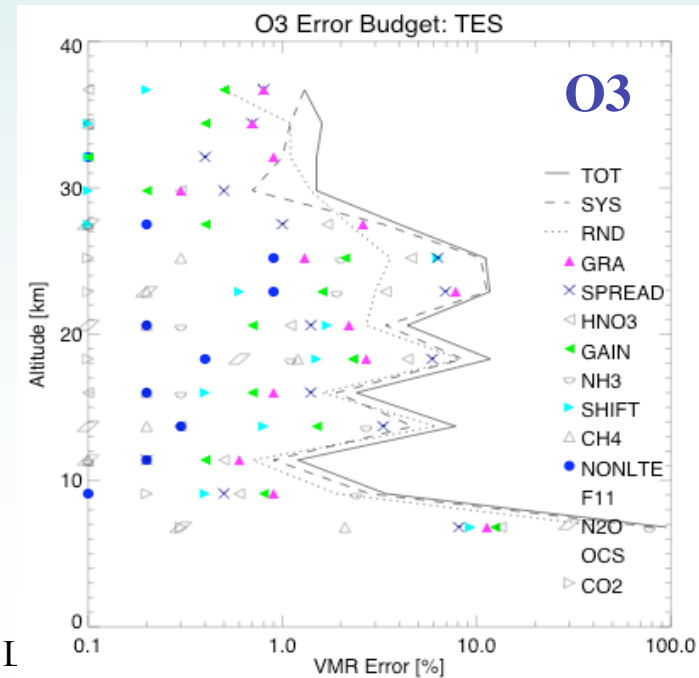
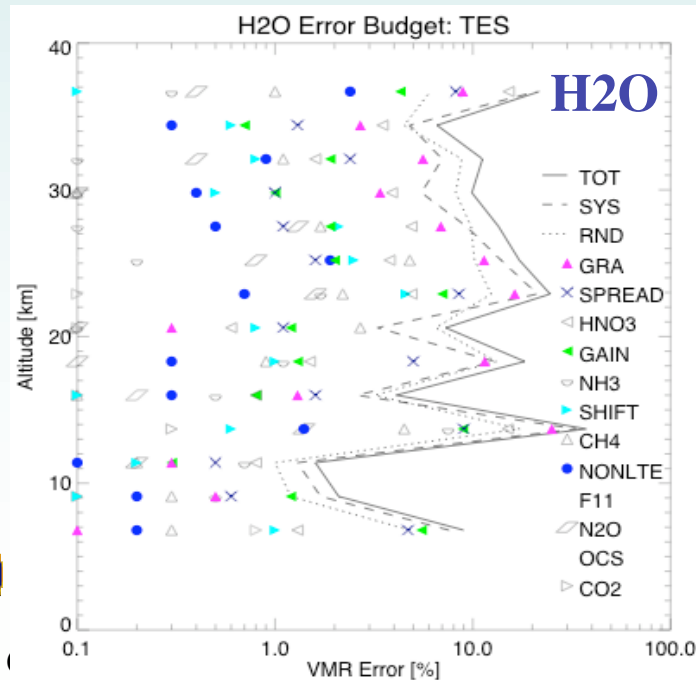
TES Total Error Budget:

Total error (TOT): solid line

Systematic error (SYS): dashed line

Random error (RND): dotted line

Symbols: different systematic sources



MIPAS and TES Retrievals

- ❖ Optimal Estimation Technique with a-priori information to constrain the retrieval.
- ❖ Retrieval grid:
 - ❖ MIPAS tangent pressure
 - ❖ one TES pressure (array detectors)
- ❖ Cloud detection:
 - ❖ MIPAS band A [650-970 cm^{-1}]
 - ❖ TES band 2A1 [1100-1325 cm^{-1}]
- ❖ Retrievals of pressure, temperature and 3 target species (H_2O , O_3 and HNO_3) for 28Jan05.

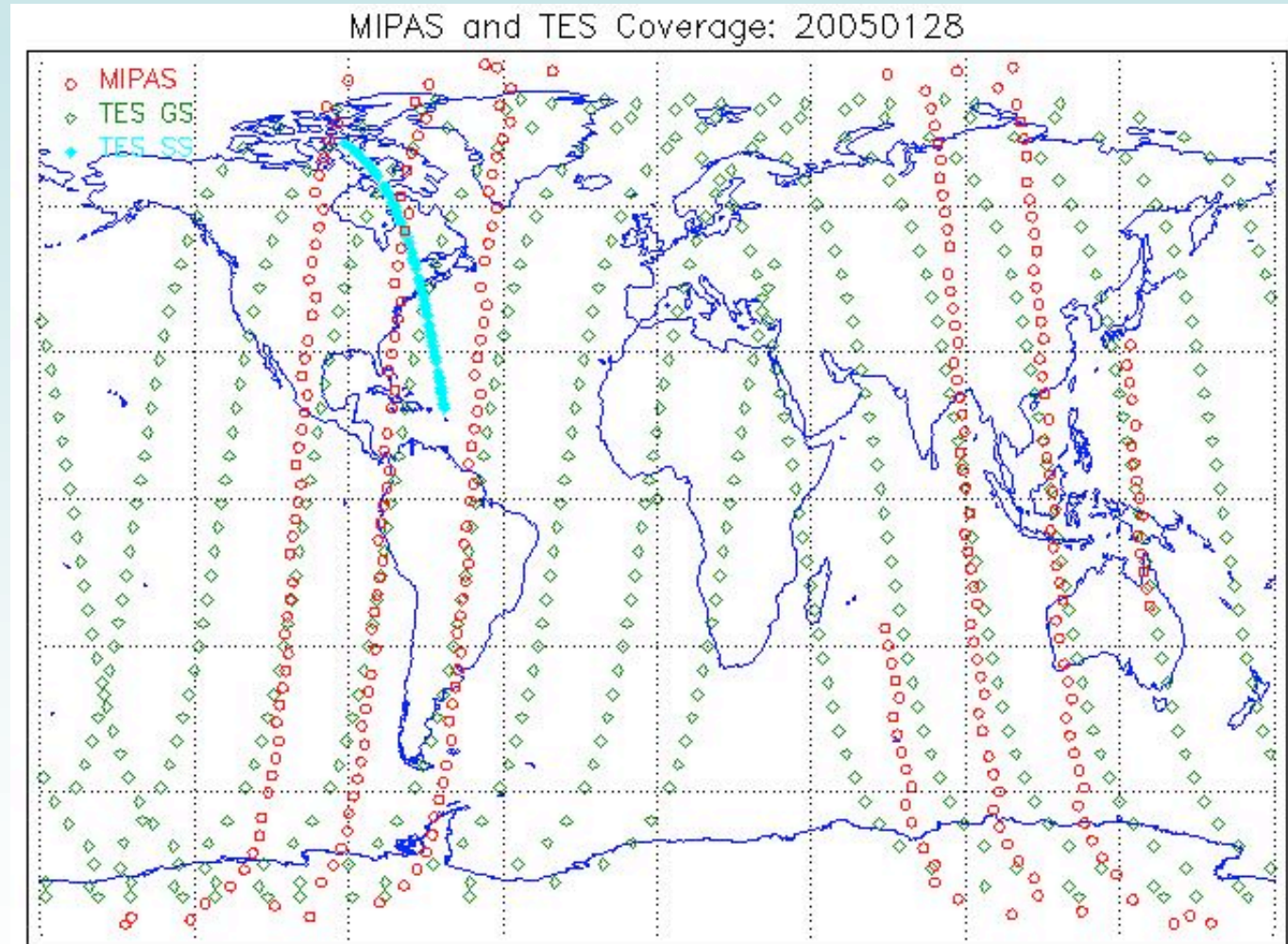


MIPAS and TES coverage for 28Jan05

MIPAS

**TES
Global
Survey**

**TES
Step&Stare**

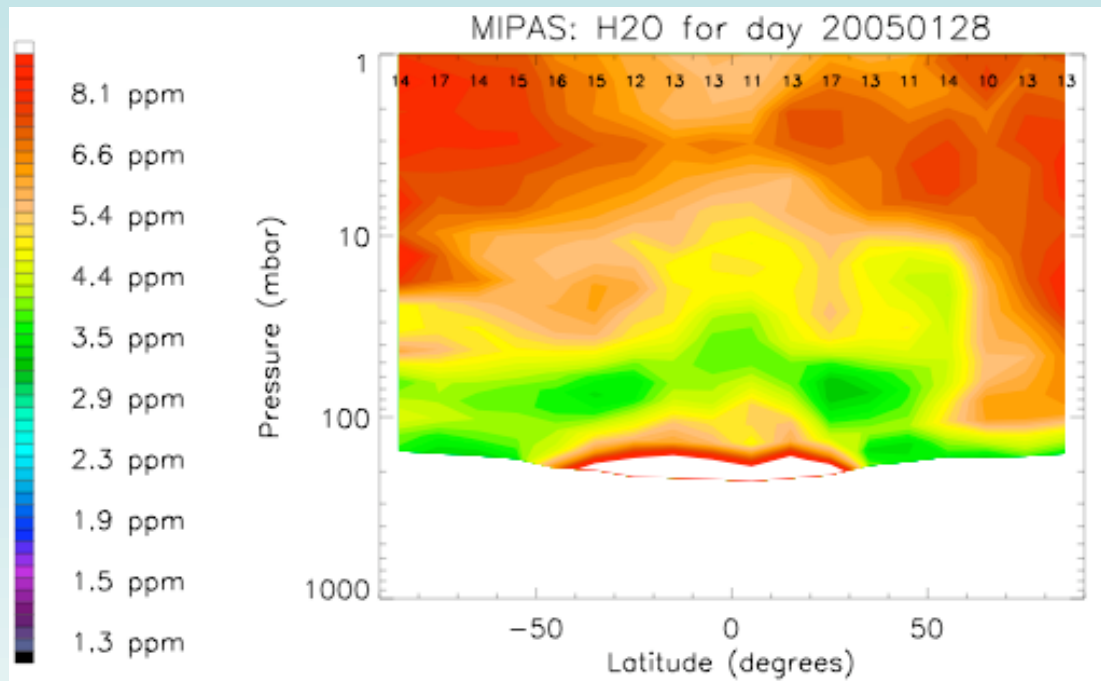


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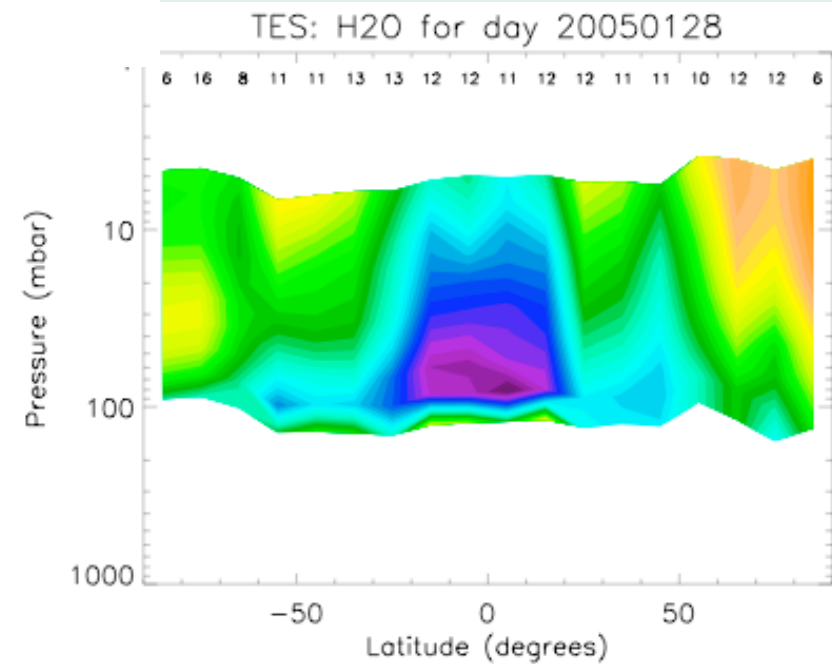
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MIPAS H2O



TES H2O

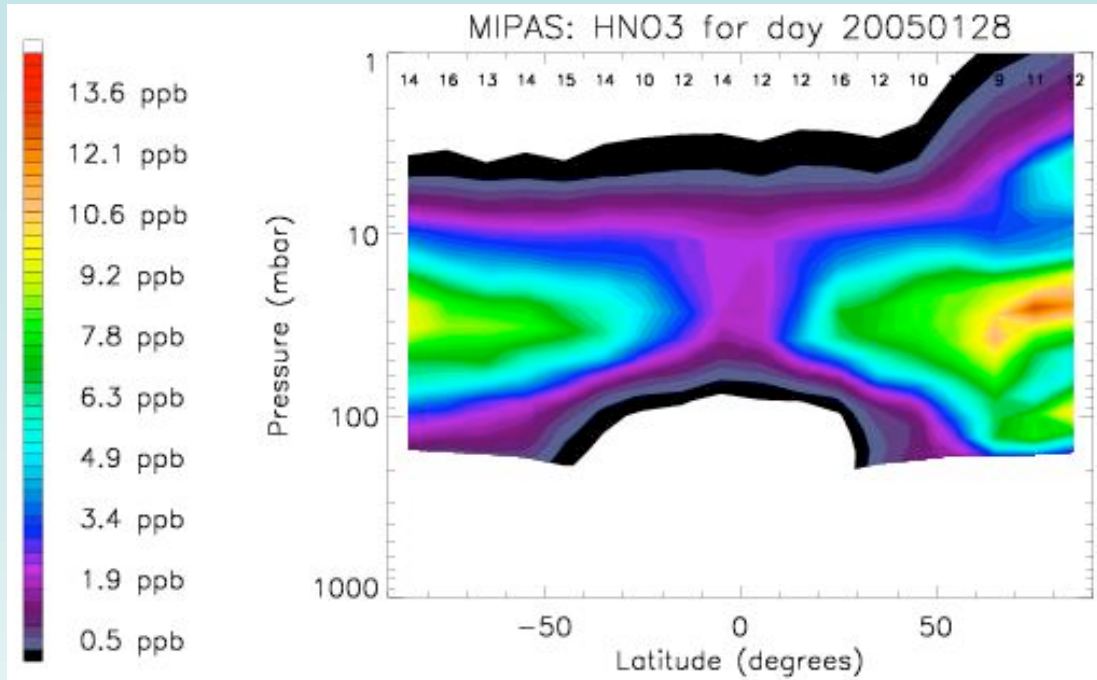


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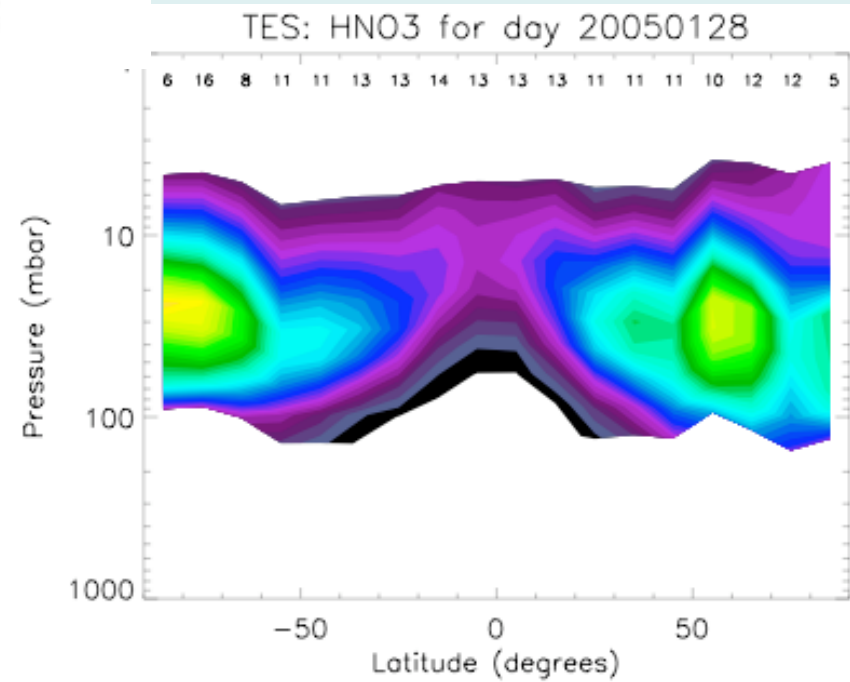
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MIPAS HNO₃



TES HNO₃



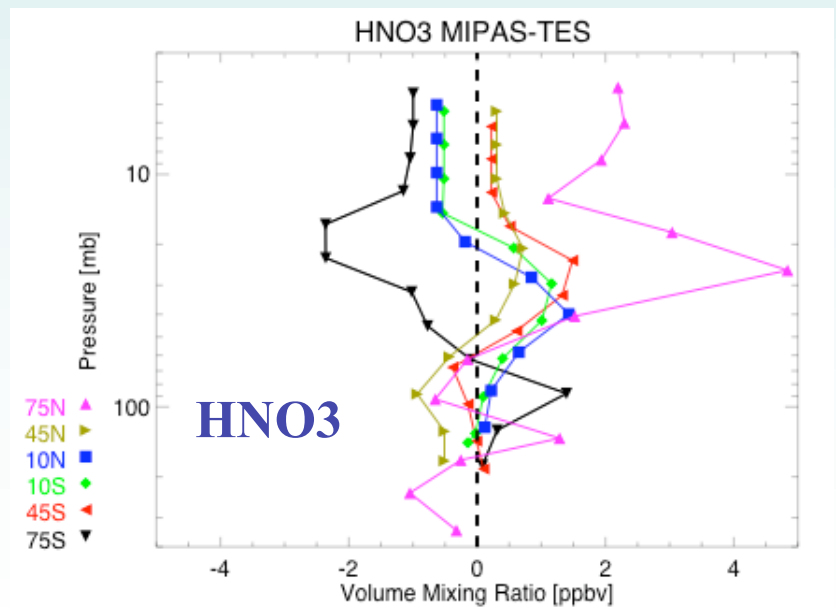
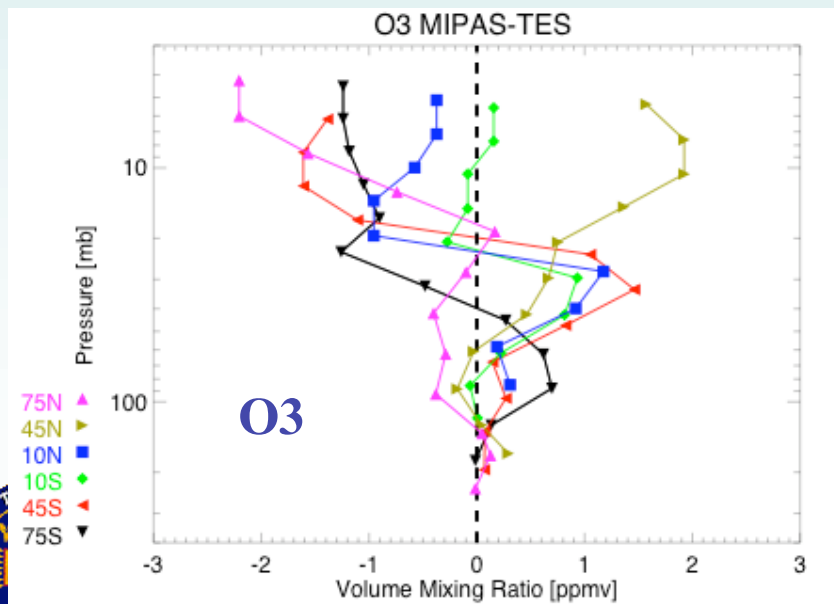
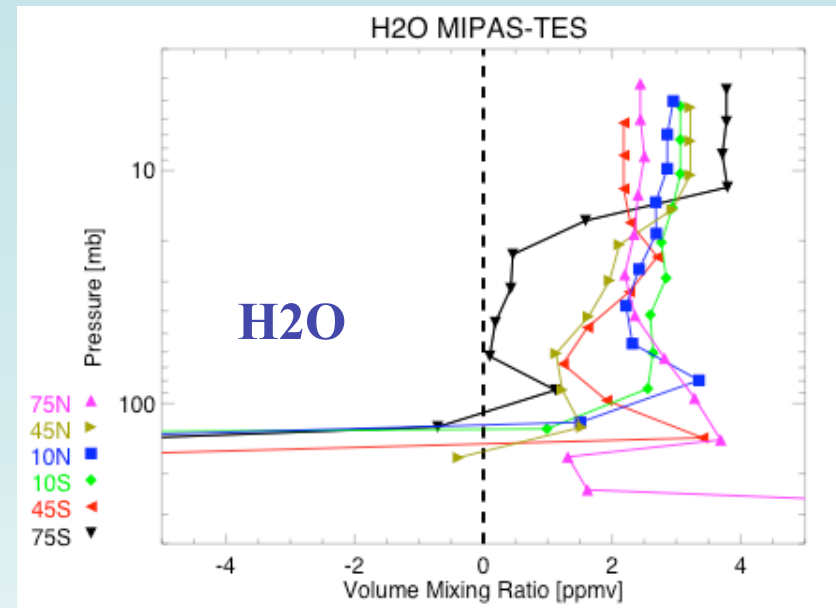
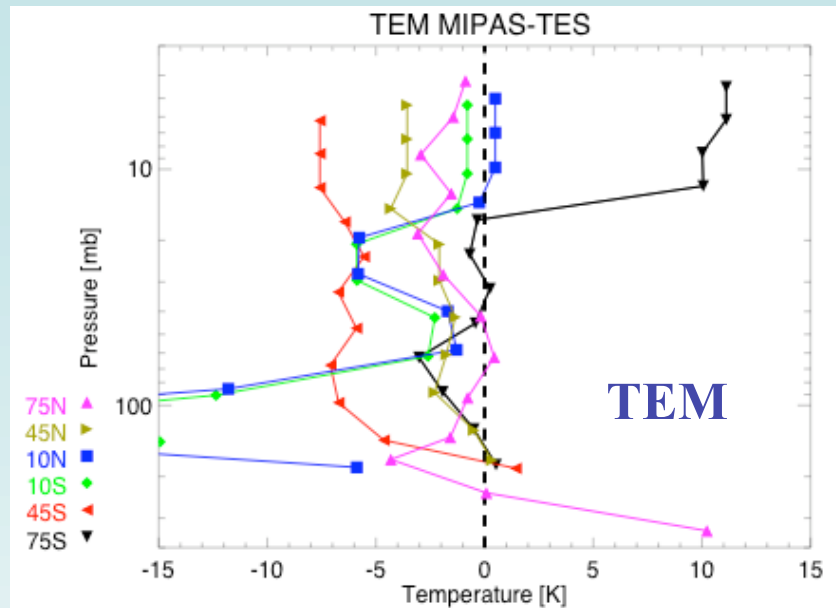
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Comparison: MIPAS - TES

- ❖ Coincidences: profile distance within 300 km
- ❖ MIPAS profiles interpolated on TES grid
- ❖ Differences (MIPAS - TES) averaged for 6 latitude bands:
90N-65N, 65N-20N, 20N-EQU, EQU-20S, 20S-65S, 65S-90S
- ❖ Plots of averaged differences: T, H₂O, O₃, HNO₃





Preliminary Results

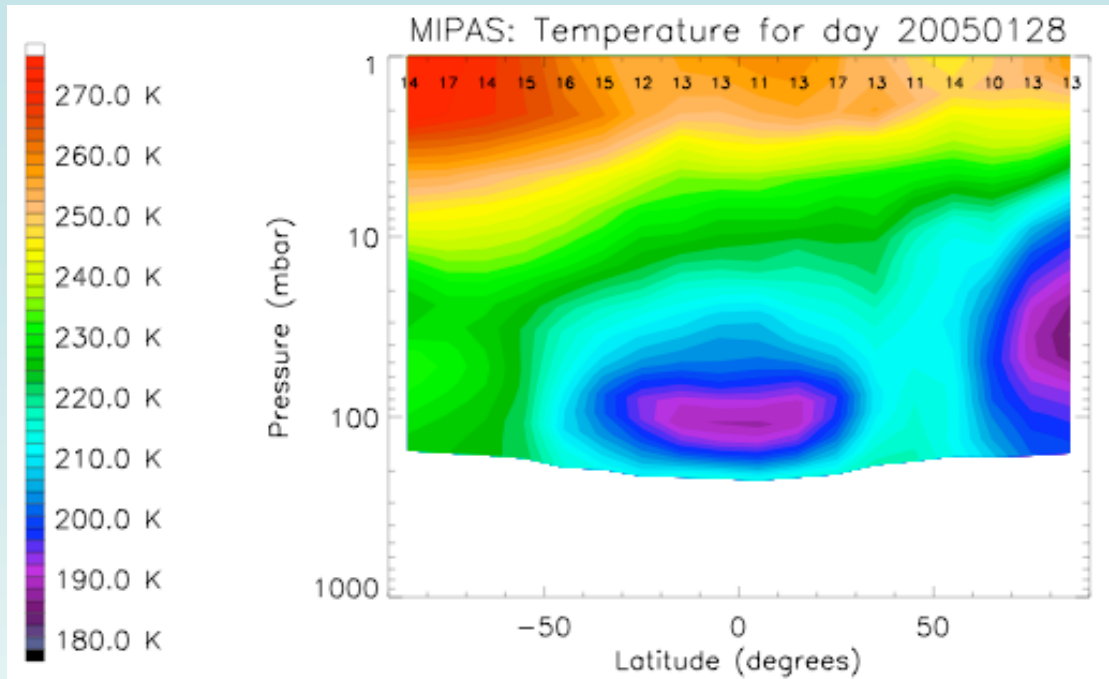
- ❖ **TEM**: TES higher ($\sim 4\text{K}$) in all latitude bands, more than 15K difference for EQU latitudes
- ❖ **H₂O**: TES lower ($\sim 2\text{ppm}$) in all latitudes bands
- ❖ **O₃**: Agreement within 1ppm below 30 mbar and within 2ppm above for all latitude bands
- ❖ **HNO₃**: Agreement within 2ppb at all altitudes and latitude bands but 75N

Further work

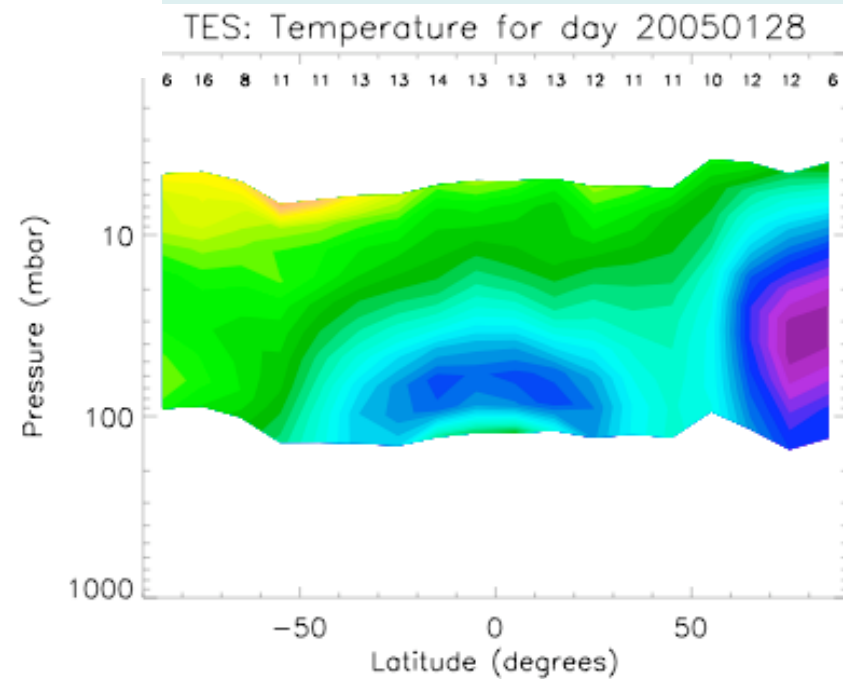
- ❖ Include quality control on TES L1B data and remove retrieved points biased by a-priori information
- ❖ Apply same cloud filtering scheme
- ❖ Select better spectral microwindows
- ❖ Improve L1B calibration and retrieval set-up



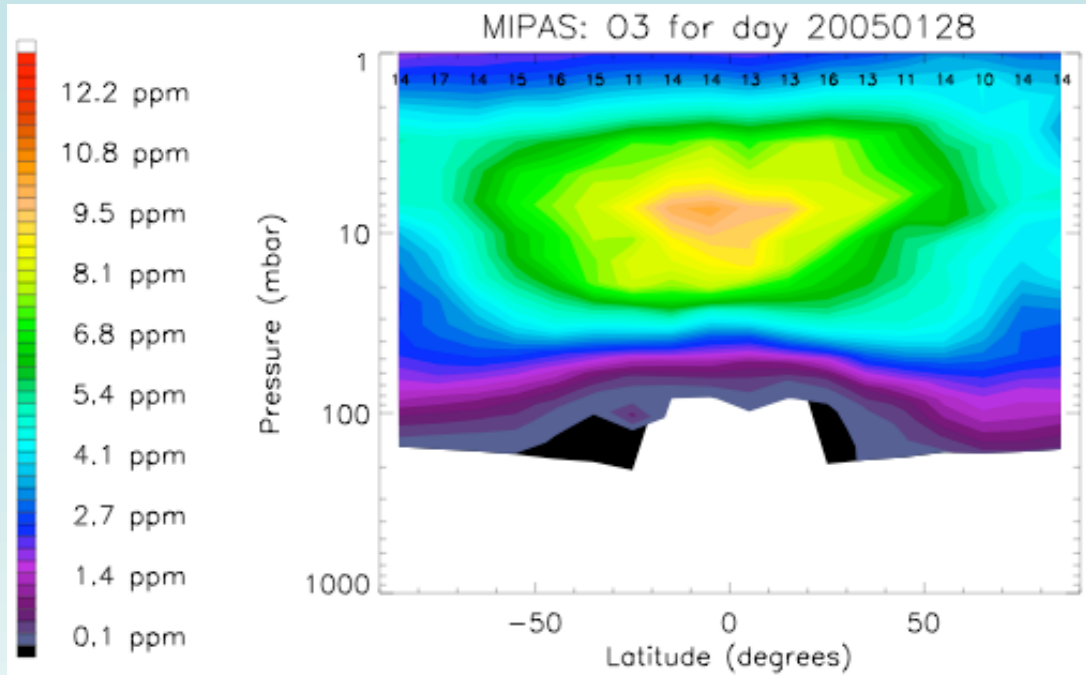
MIPAS TEM



TES TEM



MIPAS O3



TES O3

